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Indian Standard

SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS

PART V MAGNETIC SOUND TAPE RECORDING AND REPRODUCING EQUIPMENT

UDC 681·846·7

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS

PART V MAGNETIC SOUND TAPE RECORDING AND REPRODUCING EQUIPMENT

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SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS

PART V MAGNETIC SOUND TAPE RECORDING AND REPRODUCING EQUIPMENT

0. FOREWORD

0.1 This Indian Standard (Part V) was adopted by the Indian Standards Institution on 25 September 1980, after the draft finalized by the Recording Sectional Committee had been approved by Electronics and Telecommunication Division Council.

0.2 This standard covers the performance requirements for magnetic sound tape recording and reproducing equipment.

0.3 Other standards of this series consist the following parts:

Part I General
Part II Amplifiers
Part III Loudspeakers
Part IV Record playing equipment and cartridges

0.4 While preparing this standard, assistance has been derived from the following:

IEC Doc : 29B (C.0) 74 'High-fidelity audio equipment and systems. Minimum performance requirements. Part 4 Magnetic recording and playback equipment' issued by International Electrotechnical Commission.

DIN 45500 Blatt 4 — Hi-fi techniques. Minimum requirements for spool and cassette tape recorders.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part V) specifies the performance requirements for magnetic sound tape recording and reproducing equipment, comprising the derive system for the tape (reel-to-reel, cassette/or cartridge equipment), and the recording and reproducing amplifiers, and intended for high fidelity sound recording and reproducing systems for home use.

2. TERMINOLOGY

2.0 For the purpose of this standard, the terms and definitions covered in IS : 1885 (Part XLVIII/Sec 1)-1978* shall apply in addition to the following.

2.1 Reproduce Channel Unbalance — The reproduce channel unbalance is the difference in decibels of the output levels of two or more channels when reproducing a signal of frequency identical to that of the level section of the specified calibration tape.

2.2 Maximum Output Level — The output level at which a specified percentage of distortion occurs.

3. GENERAL CONDITIONS FOR MEASUREMENTS

3.0 Provisions of **3** of IS : 8655 (Part I)-1977† and **3** of IS : 7594 (Part I)-1978‡ shall apply as applicable, in addition to the following.

3.1 During the measurements, when an input (or an output) has to be terminated with the rated source impedance (or the rated load impedance), an additional parallel capacity of 250 pF inclusive of the capacitance of the measuring cable, shall be included.

3.2 During the measurements on non-equalized inputs, when the rated source current or the rated source emf has to be applied, the following values shall be used instead of any other value stated by the manufacturer.

a) rated source current 0·5 mV/kΩ of rated load impedance.

b) rated source emf 0·5 V.

4. OPERATING CONDITIONS

4.1 Provisions of **4** of IS : 8655 (Part I)-1977† and **4** of IS : 7594 (Part I)-1978‡ shall apply, as applicable.

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*Electrotechnical vocabulary: Part XLVIII Recording Sec 1 Tape recording [*superseding* IS : 1885 (Part III/Sec 3)-1967].

†Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

‡Magnetic sound tape recording and reproducing equipment (cassette): Part I Methods of measurement.

5. SPOOLS AND CASSETTES

5.1 The equipment shall be capable of handling all spools conforming to IS : 8234-1976* and cassettes conforming to IS : 6370-1971†, as applicable.

6. RECORDING AND REPRODUCING MEDIUM

6.1 The recording and reproducing medium shall be magnetic tape conforming to IS : 4480 (Part I)-1976‡, IS : 4480 (Part II)-1974§ and IS : 9702-1980||, as applicable.

7. INDICATORS CONTROLS AND OTHER FEATURES

7.1 Provisions of **5** of IS : 8655 (Part III)-1977¶ and **5** of IS : 7594 (Part II)-1979** shall apply, as applicable.

8. POWER SUPPLY

8.1 Provision of **6** of IS : 8655 (Part III)-1977¶ and **6** of IS : 7594 (Part II)-1979** shall apply, as applicable.

9. SAFETY

9.1 The equipment shall conform to the relevant requirements specified in IS : 616-1957†† so far as mains operation is concerned.

10. MARKING

10.1 Provision of **9** of IS : 8655 (Part III)-1977¶ and **12** of IS : 7594 (Part II)** shall apply, as applicable.

11. OPERATING AND INSTRUCTIONS MANUAL

11.1 This manual shall contain operating, maintenance and any other special instructions required for long operating life of the equipment. Service manual containing a list of parts, spares and accessories and circuit diagram shall be supplied on request.

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*Spools for magnetic tapes for sound recording and reproduction.

†Tape cassettes for domestic use.

‡Magnetic tapes for sound recording and reproduction: Part I Domestic grade.

§Magnetic tapes for sound recording and reproduction: Part II Professional grade.

||Magnetic tapes for cassettes for sound recording and reproduction.

¶Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part III Professional type.

**Magnetic sound tapes recording and reproducing equipment (cassette): Part II Domestic type.

††Code of safety requirements for mains-operated radio receivers.

12. TEST DATA

12.1 Each equipment should be tested by the manufacturers and the test data should be supplied with the equipment.

13. TESTS

13.1 Classification of Tests

13.1.1 *Type Tests* — The tests specified in Table 1 shall constitute type tests and shall be carried out in the same sequence in which they appear in Table 1.

13.1.1.1 *Number of samples* — The number of samples shall be one magnetic sound tape recording and reproducing equipment of the same model, type and rating (selected preferably at random from a regular production lot).

13.1.1.2 *Criteria of acceptance* — There shall be no single failure in any of the type tests.

13.1.2 *Acceptance Tests* — The acceptance tests shall be carried out on a limited number of samples selected in accordance with the sampling procedure given in Appendix A, and which have passed routine tests. The samples shall be subjected to the following tests in the order given below:

a) Operational test,
b) Mean deviation from rated speed,
c) Weighted (wow and flutter),
d) Overall frequency range,
e) Maximum output level, and
f) Overall weighted signal to noise erased ratio.

13.1.3 *Routine Tests* — The following tests shall be conducted on each equipment:

a) Visual examination,
b) Operational test, and
c) Maximum output level.

13.2 Performance Requirements

13.2.1 The performance requirements for type tests, acceptance tests and routine tests are given in Table 1.

13.3 Environmental Tests

13.3.1 *Climatic Sequence Test*

TABLE 1 TEST SCHEDULE

(*Clauses* 13.1.1 *and* 13.2.2)

SL No.	CHARACTERISTICS	METHOD OF MEASUREMENT	REQUIREMENT
(1)	(2)	(3)	(4)
1.	Visual examination	5.1 of IS : 8655 (Part I)-1977* or IS : 7594 (Part I)-1978†	—
2.	Operational test	5.2 do	—
3.	Mean deviation from rated speed	5.4 do	± 1·5% at rated power supply voltage (including power suppply variation of ± 10%).
4.	Weighted (wow and flutter)	5.5 of IS : 8655 (Part I)-1977* or 5.7 of IS : 7594 (Part I)-1978† If the equipment has a recording facility, the requirement applies also to the reproduction of a recording made on the same equipment. NOTE 1 — Though the meter measures peak-to-peak values, the recording indicates the wow as a percentage of the figure corresponding to one half the peak-to-peak value. NOTE 2 — The weighting network used is specified in Fig. 1 of IS : 8152 1976‡.	⩽ 0·2% peak. If the equipment has a recording possibility the requirement is valid for the reproduction of a recording made on the same equipment.
5.	Reproduce channel unbalance	The reproduce channel unbalance is the difference in decibels of the output levels of two or more channels when reproducing a signal of frequency identical to that of the level section of the specified calibration tape.	

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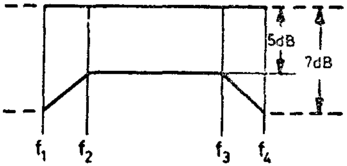
*Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

†Magnetic sound tape recording and reproducing equipment (cassette): Part I Methods of measurement.

‡Method of measurement of speed fluctuations in sound recording and reproducing equipment.

(*Continued*)

TABLE 1 TEST SCHEDULE — *Contd*

SL No. (1)	CHARACTERISTICS (2)	METHOD OF MEASUREMENT (3)	REQUIREMENT (4)
		This is given as follows: $$\left\{ 20 \log \frac{U_R}{U_L} \right\} \text{dB}$$ U_L = left output voltage derived from the level section of the relevant calibration tape. U_R = right output voltage derived from the same level section of the relevant calibration tape.	
6.	Reproduce effective frequency range	7.5 of IS : 8655 (Part I)-1977* or 5.8.3.2 of IS : 7594 (Part I)-1975†	From 40 Hz to 12 500 Hz within the tolerances defined by the diagram f_1 = 40 Hz; f_2 = 250 Hz; f_3 = 6 300 Hz; f_4 = 12 500 Hz.  If the claimed effective frequency range is wider than the minimum requirements of 40 Hz and 12 500 Hz, the tolerance of 7 dB still applies.
7.	Overall effective frequency range	8.1 of IS : 8655 (Part I)-1977* or 5.8.3.3 of IS : 7594 (Part I)-1975†	Same requirements as for Sl. No. 6.
8.	Maximum output level	2.2 of this standard. The output level shall be measured at 315 Hz and reached at a total harmonic distortion of 3 percent.	To be declared by the manufacturer.

9.	Overall unweighted signal-to-noise ratio	8.3.1 (a) of IS : 8655 (Part I)-1977* It is expressed as: $20 \log \frac{U_0}{U}$ dB where U_0 = rated output voltage, that is, the r.m.s output voltage across the rated load impedance when reproducing a tape recorded at the rated recording level (*see* Sl No. 15) U = wide band noise output voltage [in accordance with 3.9 of IS : 9302 (Part I)-1979‡]	$\geqslant$ 48 dB. NOTE — The recording gain control should be adjusted so that with the rated source current or the rated source e.m.f, the rated recording level is reached.
10.	Overall weighted signal-to-noise ratio	8.3.1 (b) of IS : 8655 (Part I)-1977* It is expressed as: $20 \log \frac{U_0}{U}$ dB where U_0 = rated output voltage (*see* Sl. No. 9) U = weighted noise output voltage (according to curve A of IS : 3932-1966§)	$\geqslant$ 56 dB. NOTE — Same as that of Sl No. 9.
11.	Separation between forward and reverse tracks	8.5 of IS : 8655 (Part I)-1977* This is expressed as separation of channel A from channel B: $20 \log \frac{(U_A)_A}{(U_A)_B}$ dB	At 1 000 Hz $\geqslant$ 60 dB Between 500 and 6 300 Hz $\geqslant$ 45 dB

*Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

†Magnetic sound tape recording and reproducing equipment (cassette): Part I Methods of measurement.

‡Characteristics and methods of measurements for sound system equipment: Part I General.

§Sound level meters for general purpose use.

(*Continued*)

TABLE 1 TEST SCHEDULE — *Contd*

SL No.	CHARACTERISTICS	METHOD OF MEASUREMENT	REQUIREMENT	
(1)	(2)	(3)	(4)	
		Separation of channel *B* from channel *A*: $$20 \log \frac{(U_B)_B}{(U_B)_A} \text{ dB}$$ $(U_A)_A$ = output voltage of channel *A* $(U_B)_B$ = output voltage of channel *B* $(U_A)_B$ = output voltage of channel *A* due to input voltage applied to channel *B* $(U_B)_A$ = output voltage of channel B due to input voltage applied to channel *A*. NOTE — Separation and cross-talk are equivalent only if: $$(U_A)_A = (U_B)_B$$		
12.	Separation between stereo tracks belonging to each other	8.5 of IS : 8655 (Part I)-1977* Separation of channel *L* from channel *R*: $$20 \log \frac{(U_L)_L}{(U_L)_R} \text{ dB}$$ Separation of channel *R* from channel *L*: $$20 \log \frac{(U_R)_R}{(U_R)_L} \text{ dB}$$	At 1 000 Hz Between 500 and 6 300 Hz	$\geqslant$ 26 dB $\geqslant$ 20 dB

		$(U_L)_L$ = output voltage of channel L $(U_R)_R$ = output voltage of channel R $(U_L)_R$ = output voltage of channel L due to input voltage applied to channel R $(U_R)_L$ = output voltage of channel R due to input voltage applied to channel L NOTE — Separation and cross-talk are equivalent only if $(U_L)_L = (U_R)_R$	
13.	Signal-to-erased signal ratio	8.6 of IS : 8655 (Part I)-1977* This may be expressed as: $20 \log \frac{U_0}{U}$ dB U_0 = rated output voltage (*see* Sl No. 9) U = residual output voltage	$>$ 60 dB at 1 000 Hz.
14.	Maximum start time to record/reproduce speed	5.7 of IS : 8655 (Part I)-1977*	$<$ 1 s
15.	Rated recording level	That level, specified by the manufacturer, which when recorded on the reference tape gives the rated output voltage across the rated load impedance at an appropriate setting of the reproducing gain controls, the third harmonic distortion being 3 percent.	The signal frequency shall be: 315 Hz for 4·76 cm/s and 9·53 cm/s 1 000 Hz for 19·05 cm/s and 38·1 cm/s The third harmonic distortion shall be measured according to as given in Appendix B.

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*Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

(*Continued*)

TABLE 1 TEST SCHEDULE — *Contd*

Sl No.	CHARACTERISTICS	METHOD OF MEASUREMENT	REQUIREMENT
(1)	(2)	(9)	(4)
16.	Environmental Tests	13.3 of this standard	The following tests shall be carried out after the environmental tests and shall meet the corresponding requirements specified in this standard: a) Operational test b) Mean deviation from rated speed c) Wow and flutter d) Rated output voltage

13.3.1.1 *Dry heat* — This test shall be carried out at a temperature of 40°C and duration of 96 hours in accordance with IS : 9000 (Part III/ Sec 5)-1977*.

13.3.1.2 *Damp heat (first cycle)* — The first cycle shall be carried out in accordance with IS : 2106 (Part II)-1962†.

13.3.1.3 *Cold* — This test shall be carried out at a temperature of —10°C and duration of 16 hours in accordance with IS : 9000 (Part II)-1977‡.

13.3.1.4 *Damp heat (second cycle)* — The second cycle shall be carried out in accordance with IS : 2106 (Part II)-1962† after a recovery period of 24 hours.

13.3.2 *Bump Test* — This test shall be carried out in accordance with IS : 9000 (Part VII/Sec 2)-1979§ with 4 000 bumps with an acceleration of 400 ± 40 m/Sec^2.

13.3.3 *Drop Test* — This test shall be conducted in accordance with **9.2** of IS : 9000 (Part VII/Sec 3)-1979‖, the height of drop being 25 mm.

13.3.4 *Vibration Test* — This test shall be conducted in accordance with IS : 2106 (Part XVI)-1971¶.

Frequency range	10-150 Hz
Amplitude	0·15 mm or 2 g
Duration	6 hours

13.3.5 *Dust Test* — This test shall be carried out in accordance with IS : 2106 (Part XII)-1965**.

13.3.6 *Salt Mist Test* — This test shall be carried out in accordance with IS : 2106 (Part XVIII)-1973††.

---

*Basic environmental testing procedures for electronic and electrical items: Patt III Dry heat test, Section 5 Dry heat test for heat dissipating items with gradual change of temperature.

†Environmental tests for electronic and electrical equipment: Part II Damp heat (cycling) test.

‡Basic environmental testing procedures for electronic and electrical Items: Part II Cold test.

§Basic environmental testing procedures for electronic and electrical items: Part VII Impact test, Section 2 Bump.

‖Basic environmental testing procedures for electronic and electrical items: Part VII Impact test, Section 3 Drop and topple.

¶Environmental tests for electronic and electrical equipment: Part XVI Vibration test.

**Environmental tests for electronic and electrical equipment: Part XII Dust test.

††Environmental tests for electronic and electrical equipment: Part XVIII Salt mist test.

APPENDIX A

(*Clause* 13.1.2)

SAMPLING AND CRITERIA FOR CONFORMITY

A-1. LOT

A-1.1 All the magnetic sound tape recording and reproducing equipment of the same model and type having the same design and manufactured by the same technique under eventually similar conditions of production shall constitute a lot.

A-1.1.1 Samples shall be taken and tested to ascertain the conformity of each lot for acceptance tests.

A-2. SCALE OF SAMPLING

A-2.1 The equipment shall be taken at random as per columns 1, 2 and 3 of Table 2 (*see* IS : 4905-1968*).

TABLE 2 SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

(*Clauses* A-2.1, A-3.1 *and* A-3.1.1)

LOT SIZE (N) (1)	FIRST SAMPLE (N_1) (2)	SECOND SAMPLE (N_2) (3)	COMBINED SAMPLE ($N_1 + N_2$) (4)	ACCEPTANCE NUMBER (5)	REJECTION NUMBER (6)
Up to 150	5	5	10	0	2
151 to 300	8	8	16	0	2
301 and above	13	13	26	0	2

A-3. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

A-3.1 The equipment shall be drawn from each lot as per col 1 and 2 of Table 2 and subjected to the acceptance tests specified in **13.1.2.** If the equipment fails in any one of the acceptance tests, it shall be called as defective. If the number of defectives found in the first sample (*see* col 2) is zero (*see* col 5), the lot shall be considered as conforming to the acceptance tests. If the number of defectives is as equal to or greater than two (*see* col 6), the lot shall be considered as not conforming to the acceptance tests.

A-3.1.1 If the number of defectives is equal to one, further samples of receivers shall be taken as per col 3 of Table 2 and tested for all the acceptance tests. If the number of defectives in the combined sample (*see* col 4), is less than two (*see* col 6), the lot shall be considered as conforming to the acceptance tests, otherwise rejected.

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*Methods for random sampling.

APPENDIX B

[*Table* 1, Sl No. (15)]

MEASUREMENT OF THIRD HARMONIC DISTORTION

A-1. DEFINITION

A-1.1 The third harmonic distortion content is expressed as a percentage of the output voltage U_0 derived from reproducing from the specified reference tape, a magnetic flux identical to that of the rated recording level, at a frequency equal to that of the level section of the specified calibration tape.

A-2. For this measurement, the adjustable reproduce gain and equilisation controls (if any) shall be set as determined in **7.5** of IS : 8655 (Part I)-1977*.

A signal of frequency identical to that of the level section of the specified calibration tape is recorded on the specified reference tape at rated recording level, resulting, on reproduction, in an output voltage U_0.

The voltage U corresponding to the third harmonic component of the output voltage U_0 is measured via a narrow-band filter.

The voltage U is corrected if necessary, for the transmission factor of the filter.

Third harmonic distortion is given as $\frac{U}{U_0} \times 100\%$.

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*Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

INDIAN STANDARDS
ON
RECORDING

IS :

1885 (Part XLVIII/Sec 1)-1978	Electrotechnical vocabulary: Part XLVIII Recording, Sec 1 Tape recording [*Superseding* IS : 1885 (Part III/Sec 3)-1967]
1885 (Part XLVIII/Sec 2)-1978	Electrotechnical vocabulary: Part XLVIII Recording, Sec 2 Disk recording [*Superseding* IS : 1885 (Part III/Sec 3)-1967]
2032 (Part XII)-1969	Graphical symbols used in electrotechnology: Part XII Electro-acoustic transducers and recording and reproducing systems
3956-1967	Dimensions of spools for magnetic tapes for sound recording and reproduction
4377-1967	General requirements for magnetic tapes for sound recording and reproduction
4479-1967	Methods of measurements on magnetic tapes for sound recording and reproduction
4480 (Part I)-1967	Magnetic tapes for sound recording and reproduction: Part I Domestic Grade
4480 (Part II)-1974	Magnetic tapes for sound recording and reproduction: Part II Professional grade
6370-1971	Tape cassettes for domestic use
6391-1971	Magnetic and ceramic phonograph pick-ups
7068-1973	6·25 mm calibration tape
7594 (Part I)-1978	Magnetic sound tape recording and reproducing equipment (cassette): Part I Methods of measurement
7594 (Part II)-1975	Magnetic sound tape recording and reproducing equipment (cassette): Part II Domestic tape
8152-1976	Method of measurement of speed fluctuations in sound recording and reproducing equipment
8234-1976	Spools for magnetic tapes for sound recording and reproduction
8655 (Part I)-1977	Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement
8655 (Part III)-1977	Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part III Professional type
9272 (Part I)-1979	Disk record playing equipment: Part I Record player
9272 (Part II)-1979	Disk record playing equipment: Part II Amplifiers and loudspeakers
9305-1979	Processed disk records